VASCULAR AND ENDOVASCULAR SURGICAL TECHNIQUES

An Atlas

Third Edition

Edited by

ROGER M. GREENHALGH MA, MD, MChir, FRCS

Professor of Surgery, Charing Cross and Westminster Medical School, London, UK

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Transfemoral intraluminal graft implantation for abdominal aortic aneurysms

JUAN C. PARODI MD

Chief, Department of Vascular Surgery, Instituto Cardiovascular de Buenos Aires, Buenos Aires, Argentina and Adjunct Associate Professor of Surgery, Bowman Gray School of Medicine, Wake Forest University, Winston–Salem, North Carolina, USA

Introduction

Dacron replacement of abdominal aortic aneurysm has followed an established technique since Dubost's first operation with homograft in 1952. The procedure involves a generous incision and related hospital stay. Improvements in materials, anaesthetic and surgical techniques have led to a fairly safe procedure today. Nonetheless, in some cases where the aneurysm is large and there are associated morbid conditions the attendant risks of surgical intervention are prohibitive. Alternative treatment in these cases includes the exclusion technique followed by extra-anatomical bypass (Blaisdell, Hall and Thomas, 1965). Others have combined this approach with catheter occlusion techniques. These alternatives have neither eliminated the risk of rupture nor decreased the incidence of mortality (Schemzer, Papa and Miller, 1985; Kwamm and Dahl, 1984).

Rapid development of endovascular techniques and instrumentation have given rise to the development of a transluminal graft technique in the treatment of an abdominal aortic aneurysm in patients who are poor surgical risks.

Principles and justification

Indications

The sole indication for this procedure is confined to those patients for whom conventional open surgical intervention represents an excessive risk. With increasing experience and extended follow-up demonstrating the safety and patency of these grafts, the procedure may also be extended to patients who are considered for elective replacement of an abdominal aortic aneurysm.

Certain anatomical conditions should be present to make the procedure technically feasible, these are: (1) a proximal and distal neck (or cuff) of more than 2 cm; (2) a suitable iliac axis and at least one patent iliac artery. The iliac artery should be more than 7 mm in diameter with a straight or nearly straight axis.

Preoperative

Assessment

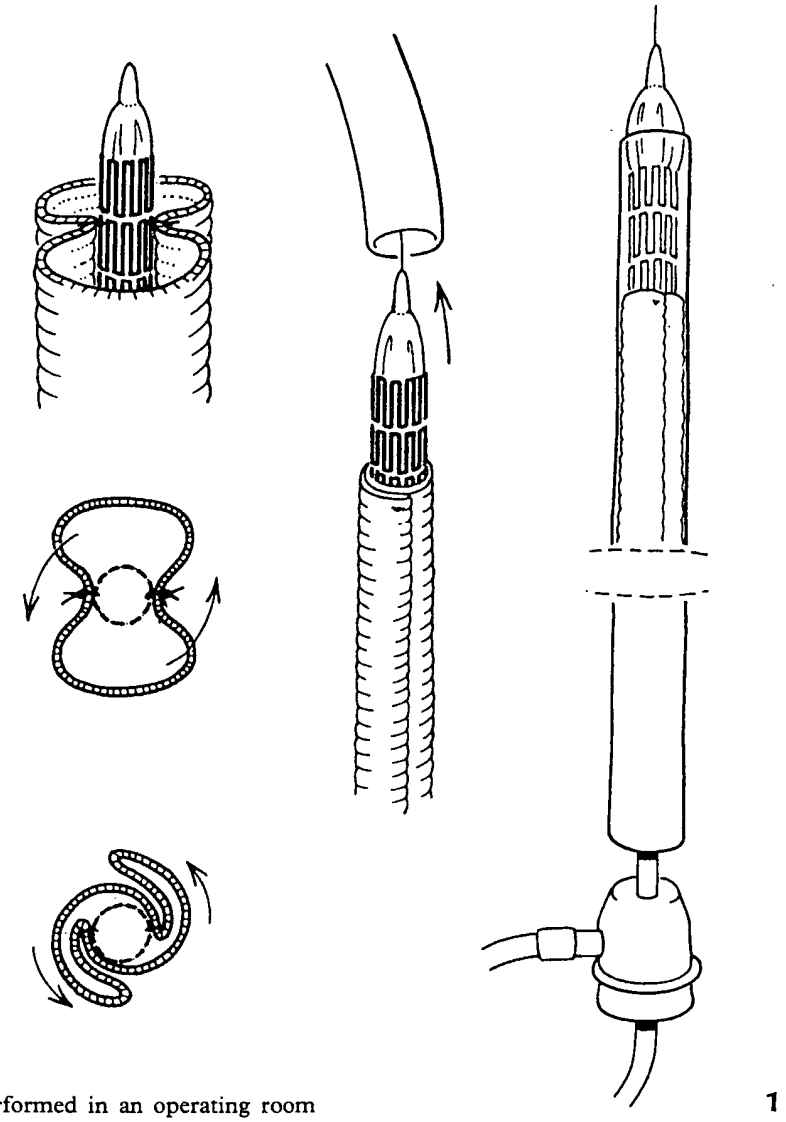
In addition to routine studies to evaluate patients for aortic surgery, all patients require infusion computed tomographic (CT) scanning and complete arteriography. For precision diameter measurement the CT scan slices should be set at 5 mm intervals. Three-dimensional reconstruction, particularly with the spiral CT scanning method, will help to evaluate the diameter and length of both the neck and distal aorta. Arteriography will identify accurately the neck of the aneurysm and its proximity to orifices of the renal artery and the actual length of the aorta measured from the renal arteries to the aortic bifurcation. The status of the visceral artery, the presence of a meandering mesenteric artery or dual renal artery, and the patency of the inferior mesenteric artery arc also best assessed by arteriography. Arteriography also gives vital information about the status of the iliac artery and its patency.

Instrumentation

The device consists of a graft-stent combination. This technique is based on the concept that stents may be used in place of sutures to fix the proximal and distal ends of a fabric graft along the length of the aneurysm. Experimental studies have shown that stents could replace surgical sutures and could act as a friction seal to fix the ends of a graft to the vessel wall. These friction seals were developed by creating a transluminal graft-stent combination, by suturing a modified Palmaz balloon expandable stent on the particle overlapping ends of a tubular, knitted Dacron graft. This was done so that stent expansion would press the graft against the aortic wall, creating a watertight seal.

1

The assembly comprises a balloon expandable stent, 5.5 mm in diameter and 3.5 cm in length. These are stainless steel, modified Palmaz stents. A specially made, thin-walled, crimped knitted Dacron graft (Barone Industries, Buenos Aires, Argentina) is sutured to the stents, overlapping half of the length of the stent.



1

Patient preparation

The procedure should be performed in an operating room equipped with fluoroscopic equipment. A mobile C-Arm image intensifier providing real-time digital subtraction with instantaneous replay of each digital exposure and roadmapping is ideal. The patient should be prepared and draped as for aortic surgery. The anaesthesia team should be alerted about the possibility of immediate surgical intervention.

Operation

2

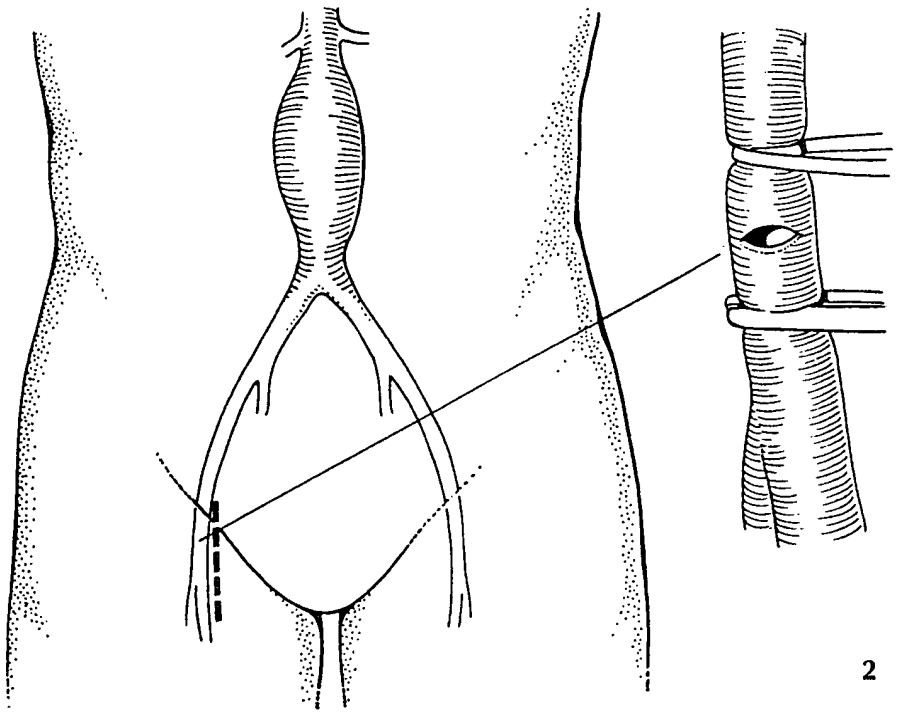
Incision

Under local anaesthesia, the common femoral artery is exposed through a standard groin incision. In general, the common femoral artery is chosen on the side of the iliac artery with a straighter course and with fewer atherosclerotic changes.

Once 5000 i.v. units of heparin has been given, an 18-gauge Cournand needle is introduced and manoeuvred cephalad into the common femoral artery. A soft-tip (0.38 inch) guidewire is advanced through the needle into the distal thoracic aorta, and a 5-French pigtail catheter is introduced over the guidewire. When the catheter is positioned in the visceral segment of the abdominal aorta, the guidewire is withdrawn and preoperative arteriography performed. The pigtail catheter has radio-opaque calibrations at 20 mm intervals. In order to obtain measurements from the arteriogram, a radio-opaque rule is placed behind the patient parallel to the axis of the aorta.

When the intraoperative measurements have been compared with those determined properatively, an endoluminal device of suitable size is selected. The graft overlaps the proximal stent by one-half and is attached to it using braided, synthetic suture material.

After the stent has been mounted over the balloon, the graft is folded (as shown in *Illustration 1*) and the entire assembly is introduced into an 18-French polytetrafluoroethylene sheath through a transverse arteriotomy.

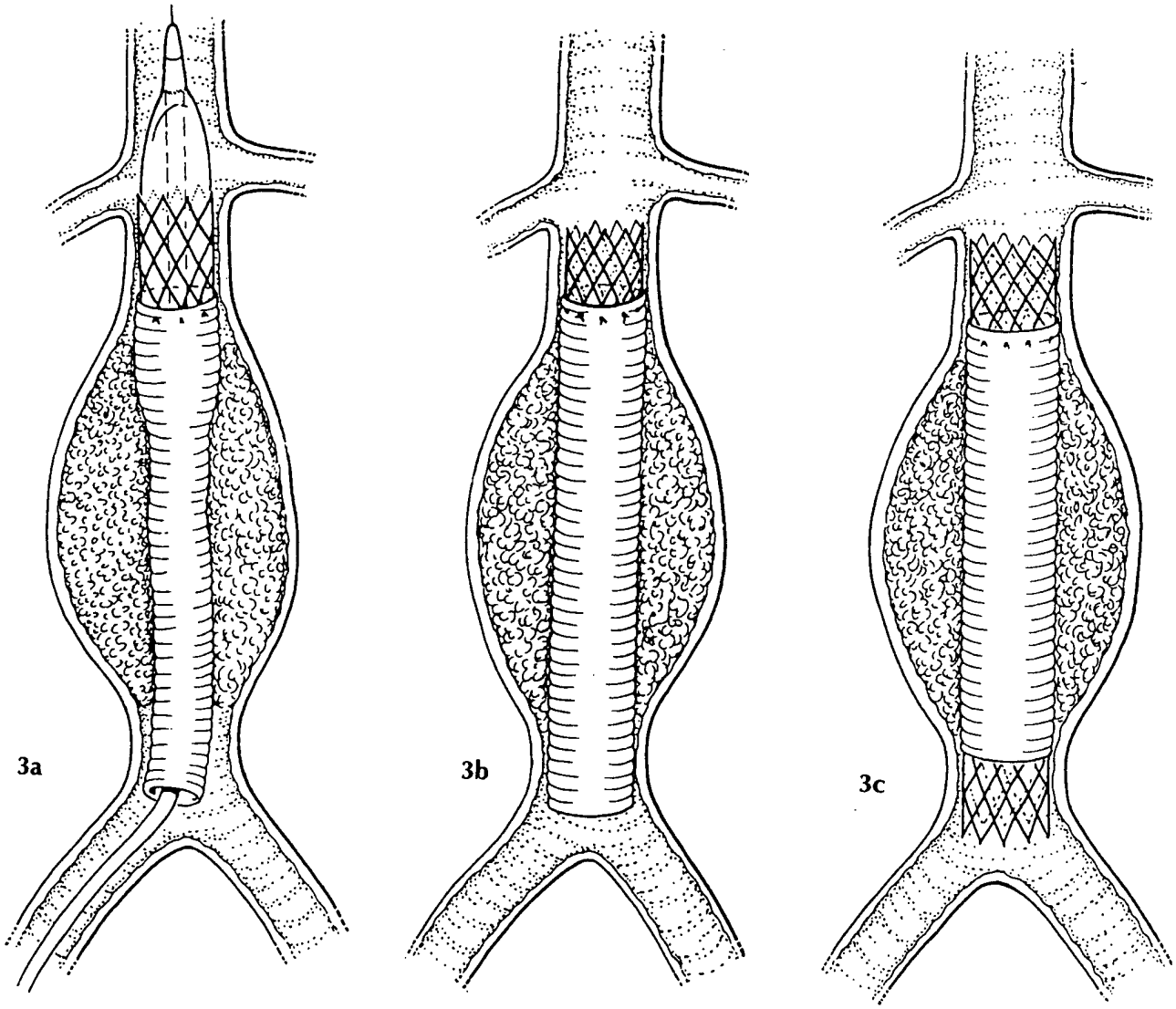


2

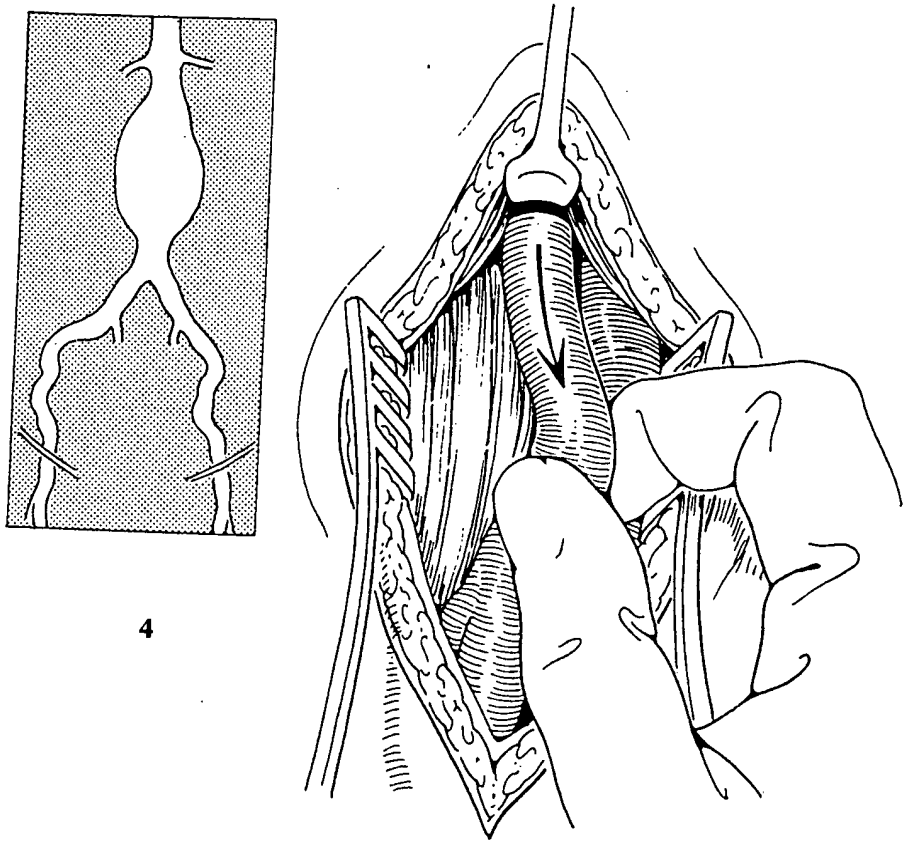
3a, b & c

A guidewire is reintroduced, the pigtail catheter is removed, and the wire is replaced with a super-stiff wire. The sheath containing the device is advanced over the wire to the level of the proximal neck of the aneurysm. The sheath is then removed, leaving the graft, stent and balloon in the aortic lumen. Attention is now paid to lowering blood pressure. The author prefers to keep mean blood pressure below 80 mmHg by intravenous infusion of glyceryl trinitrate. When blood pressure is stable at this value, the proximal balloon is inflated for less than 1 min to a volume necessary to achieve an appropriate diameter for that particular patient. In order to create a perfectly cylindrical stent, the balloon can be reinflated at both ends of the stent. Occasionally, the stent shape must be adapted to an irregular aneurysm neck by repeated low pressure inflations along the entire length of the stent.

After the proximal stent has been deployed, the balloon is inflated along the shaft of the graft to distend it under low pressure. Provided all previous measurements were correct, the distal radio-opaque calibrations on the graft should be level with the aortic bifurcation. A second stent is then applied to the distal end to establish a seal preventing reflux around the graft. A completion aortogram is then obtained by introducing an arteriographic catheter over the guidewire. Arteriography confirms the success of the procedure and patency of the renal arteries. The guidewire and overlying catheter are removed and the arteriotomy is then closed with 6/0 polypropylene suture. Extreme care is taken to ensure complete haemostasis.



3a 3b 3c



4

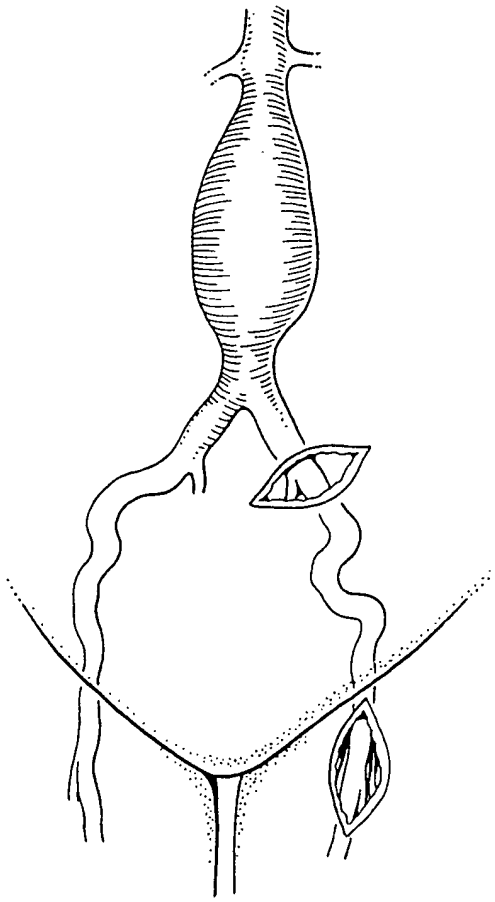
4

When both iliac arteries are very tortuous, a 'pull-down manoeuvre' can be employed. This involves circumferential dissection of the common femoral artery. By ligating some of the small branches, the external artery is then dissected bluntly. By this means the external iliac artery can be freed of the surrounding tissue and a gentle pull caudad will straighten the course of the artery and ease instrumentation.

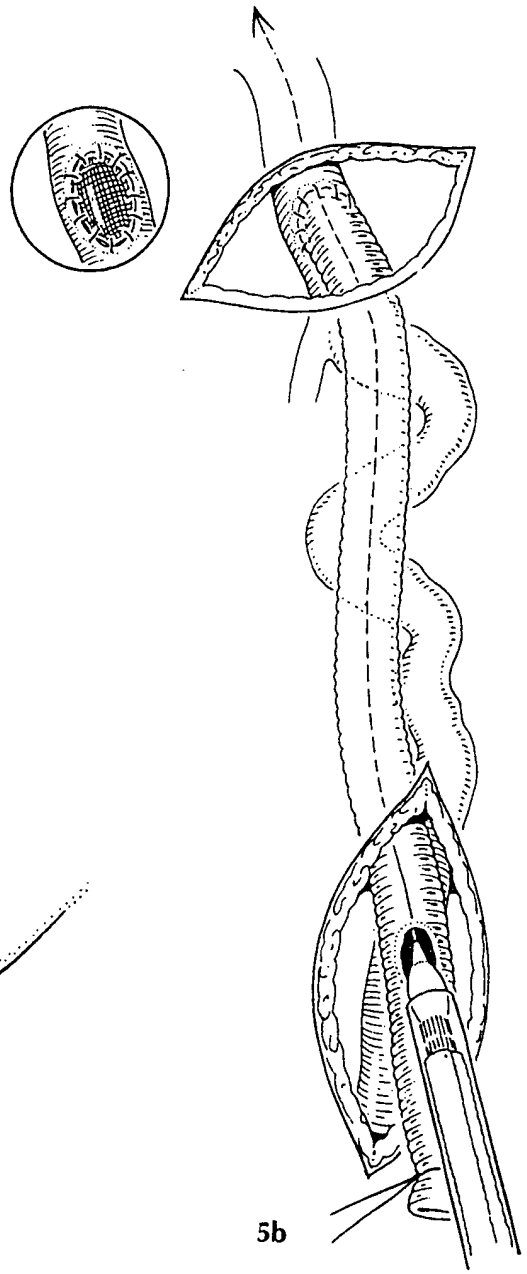
5a, b

If the above manoeuvre fails to allow passage of the device to the aorta, the alternative would be a separate incision above the tortuous area. A transverse incision similar to that required for kidney transplantation will expose the common iliac artery. A Dacron graft is then anastomosed end-to-side as shown and is tunnelled to the groin area where its distal end is externalized for instrumentation.

The defect in the common iliac artery is repaired with a patch graft subsequent to completion of the aortic procedure.



5a



5b

Postoperative

Postoperative care is as for any aortic procedure. Patency of the graft is assessed by measuring ankle pressure. Evidence of microembolization must be sought. Special attention must be paid to urine output because proximity of the device to the renal artery may cause a problem. When the patient walks, an infusion CT scan is obtained to confirm correct placement of the graft. Arteriography, if required can give further information. Patients require close monitoring during the first postoperative year and should undergo repeated CT scanning.

References

Berguer, R., Schneider, J. and Wilner, H. I. (1978). Induced thrombosis of inoperable abdominal aortic aneurysm. *Surgery* **84**, 425.

Blaisdell, F. W., Hall, A. D. and Thomas, A. N. (1965). Ligation treatment of an abdominal aortic aneurysm. *American Journal of Surgery* **109**, 560.

Dubost, C., Allary, M. and Oeconomos, N. (1952). Resection of an aneurysm of the abdominal aorta re-establishment of continuity by preserved human arterial graft with results after 5 months. *Archives of Surgery* **64**, 405.

Kwamm, J. H. M. and Dahl, R. K. (1984). Fatal rupture after successful surgical thrombosis of an abdominal aortic aneurysm. *Surgery* **95**, 235.

Laborde, J. C., Parodi, J. C., Clem, M. F. *et al.* (1992). Intraluminal bypass of abdominal aortic aneurysm: feasibility study. *Radiology* **194**, 185.

Parodi, J. C., Palmaz, J. C., Barone and H. D. (1991). Transfemoral intesluminal graft implantation for abdominal aortic aneurysm. *Annals of Vascular Surgery* **5**, 491.

Schemzer, H., Papa, M. C. and Miller, C. M. (1985). Rupture of surgically thromboses abdominal aortic aneurysm. *Journal of Vascular Surgery* **2**, 278.